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41. In apparatus for irradiating a selected region of a target material containing an excitable species in order to excite members of said species, including a source of exciting radiation adapted to exciting said members and focusing means to focus said radiation to said selected region, a method of increasing the resolution of said apparatus including the steps of:

providing a second type of radiation able to reduce the excitation of said species by said exciting radiation;

applying said second type of radiation to said selected region to preferentially decrease the excitation in a chosen part of said region; and

reducing the net intensity of said second type of radiation on at least one point in said selected region to substantially zero, except radiation of said second type arriving on said point from sources such as scattering and reflection within said apparatus and said material, not feasible to completely eliminate, thereby increasing the resolution of said apparatus.

42. The method in Claim 41, wherein the step of reducing the net intensity of said second type of radiation on at least one point in said selected region to substantially zero

includes the additional steps of providing a first source of said second type of radiation directed on said point, and a second source of said second type of radiation directed on said point, coherent with said first source, and adapted to destructively interfere, at said point, with the radiation from said first source of said second time of radiation.

43. The method in Claim 41, including the additional step of producing a first interference pattern of said second type of radiation within said selected region.

44. The method of Claim 43 wherein said first interference pattern has at least one node substantially extended in at least one dimension.

45. The method of Claim 44 including the additional step of producing a second interference pattern of said second type of radiation within said region, such that said second interference pattern has at least one node substantially extended in at least one dimension different from said dimension in Claim 44.

46. The method of Claim 45, including a step providing that radiation of said second type in said first interference pattern substantially does not interfere with radiation of said second type in said second interference pattern.

47. The method of Claim 46, wherein said step providing that radiation of said second type in said first interference pattern substantially does not interfere with radiation of said second type in said second interference pattern includes a step from the class including

producing said interference patterns at different times,

producing said interference patterns from radiation of different wavelengths,

producing said interference patterns from mutually incoherent radiation, and

producing said interference patterns from mutually coherent radiation but having phase

difference of substantially (90 + n(180))° where n is an integer.

48. The method of Claim 45, wherein said focusing means has an axis, wherein the radiation from said first interference pattern increases resolution in a first direction substantially perpendicular to said axis, and wherein the radiation from said second interference pattern increases resolution in a second direction both substantially perpendicular to said axis and also different from said first direction.

49. The method of Claim 45, wherein said focusing means has an axis, wherein the radiation from said first interference pattern increases resolution in a first direction substantially perpendicular to said axis, and wherein the radiation from said second interference pattern increases resolution in a second direction substantially parallel to said axis.

50. The method of Claim 41 wherein said focusing means has an axis, and including means to improve resolution in two mutually perpendicular dimensions perpendicular to said axis and additional means to improve resolution in the dimension parallel to said axis.

51. The method of Claim 41 wherein said radiationally excitable species are in a class including:

fluorescent molecules in a target material to be examined;

molecules in a target material consisting of a recording medium encoding information;

molecules in a target material adapted to undergo a long term change in at least one property following exposure to said exciting radiation; and

molecules in a photolithographic resist.

52. The method of Claim 41 wherein said apparatus is adapted to simultaneously image a plurality of regions in said target material, and wherein said step directing said second

type of radiation on to said material is adapted to create an interference node in each of said regions.

53. The method of Claim 41, and including additional steps of measuring radiation emitted by the irradiated portion of said material and of substantially preventing said second type of radiation from being included in the measurement of the radiation emitted by the irradiated portion of said material.

54. The method of Claim 53 wherein said measuring step uses a radiation detector and wherein said additional step for substantially preventing said radiation of said second type from being included in the measurement includes the use of an optical filter substantially opaque to said radiation of said second type, said filter being located in the optical path between said target material and said radiation detector.

55. The method of Claim 53 including the additional step of delivering said exciting radiation in short pulses and delivering said second type of radiation in short pulses which follow said pulses of exciting radiation, and wherein said additional step for substantially preventing said second type of radiation from being included in the measurement includes a step of gating the measurement off during said short pulses of said second type of radiation.

56. The method of Claim 41, wherein said species has an excitation spectrum with at least one band where radiation of a wavelength within said band produces substantially no excitation of said species, and including the step of substantially preventing the said second type of radiation from exciting said members by the step of providing the second type of radiation of a wavelength within said band.

57 The method of Claim 41 wherein said exciting radiation excites members of said

species by a multi-photon process.

58. The method of Claim 41 wherein a plurality of points are imagined simultaneously.

59. In apparatus for irradiating a selected region of a target material containing an excitable species in order to excite members of said species, including a source of exciting radiation adapted to excite said members and focusing means to focus said radiation to said selected region, mean for increasing the resolution of said apparatus including:

means for providing a second type of radiation able to reduce the excitation of members by said exciting radiation; and

means for directing said second type of radiation to said selected region so as to preferentially decrease the excitation in a chosen part of said region, and such that the intensity of said second type of radiation on at least one point in said region is substantially zero, thereby increasing the resolution of said apparatus.

60. In apparatus for irradiating a selected region of a target material containing a radiationally excitable species in order to excite members of said species, including a source of exciting radiation adapted to excite said members and focusing means to direct said radiation to a said region, means for increasing the effective resolution of said focusing means including:

means for providing a second type of radiation able to reduce the excitation of said species by said exciting radiation;

means for shaping said second type of radiation into a pattern projected into said region, said pattern containing at least one point where the intensity of said second type of